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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Michael Durr

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EXAMINER

GARDNER, SHANNON M

ART UNIT

PAPER NUMBER

1795

NOTIFICATION DATE

DELIVERY MODE

04/15/2009

ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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<b>Office Action Summary</b>	<b>Application No.</b> 10/805,770	<b>Applicant(s)</b> DURR ET AL.	
	<b>Examiner</b> Shannon Gardner	<b>Art Unit</b> 1795	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 09 February 2009 (RCE).
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1,2,4,6-18 and 20-34 is/are pending in the application.
- 4a) Of the above claim(s) 25-34 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,2,4,6-18 and 20-24 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 2/09/2009 has been entered.

### ***Response to Amendment***

Applicant's amendment of 2/09/2009 does not render the application allowable.

### ***Remarks***

Applicant has amended claims 1 and 20-24. Claims 25-34 are withdrawn from consideration and claim 19 is cancelled. Currently claims 1-2, 4, 6-18, and 20-24 are pending in the application and are considered on their merits below.

### ***Status of Objections and Rejections***

All rejections from the office action dated 9/5/2008 are withdrawn in view of Applicant's amendments. New grounds for rejection necessitated by Applicant's amendments are set forth below.

### ***Claim Rejections - 35 USC § 112***

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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3. Claims 12-14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Regarding claim 12, it is unclear as to what Applicant intends by "the ratio of the first kind of particles to the second kind of particles". Applicant is asked to clarify what ratio he intends (ratio of number of particles, size of particles, etc...). For the purposes of this action, the limitation will be treated as though it is a ratio of size of particles. Appropriate correction is required.

4. Claim 12 recites the limitation "the layer(s)" in the 2<sup>nd</sup> line of the claim. There is insufficient antecedent basis for this limitation in the claim, as claim 1 only specifies *one layer* having additionally a second kind of particles. The Examiner suggests changing "the layer(s)" to "the layer". Appropriate correction is required.

5. Claim 12 recites the limitation "the ratio" in the 2<sup>nd</sup> line of the claim. There is insufficient antecedent basis for this limitation in the claim. The Examiner suggests changing "the ratio" to "a ratio". Appropriate correction is required.

6.

### ***Claim Rejections - 35 USC § 102***

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1, 7-9, 20-21, and 24 are rejected under 35 U.S.C. 102(b) as being anticipated by Chone (EP 1271580, cited in IDS).

As to claim 1, Chone is directed to a porous film of a solar cell (Figure 1), comprising:

- A film having a front face and a back face, the film including at least two layers ("2-layer structure", [0031]), each layer having a first kind of particles of one average diameter or length and one layer of the at least two layers having additionally a second kind of particles, the second kind of particles having a larger average diameter or length than the first kind of particles that are included in each of the at least two layers ([0022]-[0027], [0031]),
- Wherein the porous film has a gradient of light scattering strength extending from the front face to the back face, with the light scattering strength increasing toward the back face (scattering increases as particle diameter increases, [0024] and [0034]).

Regarding claim 7, Chone teaches the particles being semi-conducting particles (TiO<sub>2</sub>) (abstract).

Regarding claim 8, the limitation of the at least two layers being applied subsequently is considered to be a product by process limitation. Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process (*In re Thorpe* and MPEP §

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2113). Further, Chone teaches the two layers being applied subsequently (paragraph [0031]).

Regarding claim 9, the limitations of the instant claim are considered to be product by process limitations. Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process (*In re Thorpe* and MPEP § 2113). Further, Chone teaches a doctor blading method (paragraph [0040]).

Regarding claims 20-21, Chone teaches an electronic device (solar cell) comprising a porous film according to claim 1 (title, abstract, Figure 1).

Regarding claim 24, Chone teaches the solar cell further comprising an electrolyte (Figure 1(30)).

### ***Claim Rejections - 35 USC § 103***

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

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1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

11. Claims 10-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chone (EP 1271580, cited in IDS).

Regarding claim 10, Applicant is directed above for a full discussion of Chone as directed to claim 1. Chone teaches the first kind of particles having an average diameter in the range of 10-30 nm (paragraph [0026]). In the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists (*In re Wertheim* and MPEP § 2144.05).

Regarding claim 11, Chone teaches the second kind of particles having an average diameter in the range of 100-200nm (paragraph [0026]). In the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists (*In re Wertheim* and MPEP § 2144.05).

Regarding claim 12, Chone teaches the layer having additionally a second kind of particles having a ratio of the first kind of particles to the second kind of particles is in the range of from 10:1 to 1:1, preferably from 8:1 to 2:1 (paragraph [0026]). In the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists (*In re Wertheim* and MPEP § 2144.05).

Regarding claims 13-14, Chone teaches the ratio being a weight ratio (paragraphs [0026]-[0030]). Further, as the particles of Chone are all composed of TiO<sub>2</sub>, the weight ratio and the volume ratio will be the same.

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12. Claims 2, 4, 6, 15-18, and 22-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chone (EP 1271580, cited in IDS) as applied to claim 1 above, and further in view of Usami (*Theoretical study of application of multiple scattering of light to a dye-sensitized nanocrystalline photoelectrochemical cell*, cited in IDS).

Regarding claim 2, Applicant is directed above for a full discussion of Chone as applied to claim 1. Chone teaches that when using metal oxide films of small particle size, the film does not appreciably scatter the light (Figure 3 and paragraph [0038]) but fails to specifically teach the gradient of light scattering strength starting with zero light scattering at the front face.

However, it is known in the art to graduate the light scattering strength of a porous metal oxide film of a solar cell starting with zero light scattering at a front face, as taught by Usami (Figures 2 and 4) to allow for ensured dye absorption at the small particles. (**Examiner note:** Usami teaches the small particle diameter of ~40nm (Figure 3), while Chone teaches and even smaller 10-30nm small particle ([0026])). It is the Examiner's position that the small particles of Chone will have zero light scattering strength).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to graduate the light scattering strength of a porous metal oxide film starting with zero light scattering at the front face in the device of Chone, as taught by Usami to ensure proper dye absorption at the small particles.

Regarding claim 4, Chone teaches the interspersing of small and larger metal oxide particles in a layer (having a first kind of particles of one average diameter and



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additionally at least a second kind of particles having a larger average diameter (paragraph [0026])). Chone is silent as to the porous film having three layers.

However, it is known in the porous metal oxide art to form multiple layers of varying particle diameters as taught by Usami (Figure 4) in order to increase the overall photoactive region.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the device of Chone to have multiple (3) layers as taught by Usami (Figure 4) to increase the overall photoactive region.

Regarding claim 6, Chone is silent as to the particles having a shape selected from the group consisting of rods, tubes, cylinders, cubes, parallelipeds, spheres, ball and ellipsoids. But, Chone does disclose the size of the particles in terms of diameter (paragraph [0026])).

However, it is known in the porous film for solar cell art to utilize ball shape  $\text{TiO}_2$  particles in a porous device, as taught by Usami (pp 106, 1st column, 1st paragraph and Figure 4) as such a shape is well known in the art and easy to manufacture.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize ball shaped metal oxide particles as taught by Usami in the device taught by Chone as such a shape is well known in the art and easy to manufacture.

Regarding claim 15, Chone teaches a porous film (2-layer structure) with a first kind of particles of one average diameter and a second kind of particle with a larger average diameter (paragraph [0026])).

Usami teaches a layer having only a first kind of particle (smaller particle) (see Figure 4) to ensure proper dye absorption in a solar device. Further, Usami teaches the use of multiple layers of metal oxide particles in such a porous device (Figure 4) to increase the overall photoactive region

It would have been obvious to one of ordinary skill at the time of the invention to include a layer of only one kind of particle in a plurality of layers as taught by Usami in the device taught by Chone to ensure proper dye absorption and minimize light scattering at the top of the device as well as increasing the overall photoactive region.

Further, Chone teaches the average diameter of the second kind of particle being in a range of 100-200nm (paragraphs {0024}-[0026]) and teaches the second layer having a porosity between 55% and 65% to improve the light scattering effect (paragraph [0031]). Chone in view of Usami is silent as to either (i) the average diameter of the second kind of particles being the same in each layer and the amount of the second kind of particles present in the layers varies from layer to layer or (ii) the amount of the second kind of particles present in the layers being the same in each layer and the average diameter of the second kind of particle varying from layer to layer.

However, it is taught in Chone that both the diameter of the particle as well as the density of the layer (i.e the porosity) are varied to achieve a desired light scattering effect.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention through matters of routine experimentation to optimize the changes in diameter of the second kind of particle and/or the porosity of the layer as taught by

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Chone. Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation (*In re Aller* and MPEP § 2144.05).

Regarding claim 16, Chone in view of Usami is silent as to the amount of the second kind of particles present in each layer varying from layer to layer, increases from layer to layer, and where the average diameter of the second kind of particles present in each layer varying from layer to layer, increases from layer to layer.

However, it is known in the art that increasing the diameter and/or number of particles improves the photon conversion efficiency of the cell by improving the light scattering effect (Chone, paragraph [0027] and [0031]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to increase the diameter and/or number of particles from layer to layer to further increase the light scattering effect thereby improving the photon conversion efficiency of the cell, as taught by Chone.

Regarding claims 17-18, Chone in view of Usami teaches the one layer having only a first kind of particles being closer to the front face (i.e. adjacent to the front face) of the porous film than to the back face (Usami, Figure 4).

Regarding claims 22-23, Chone is silent as to the solar cell further comprising a reflective back electrode and a light confinement layer.

However, it is known in the solar cell art to include a reflective back electrode and a light confinement layer in a solar cell to ensure effective solar energy absorption in the device, as taught by Usami (pp 108, 2<sup>nd</sup> column, 2nd paragraph).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to include a reflective back electrode and a light confinement layer in the device of Chone to ensure effective solar cell energy absorption in the cell, as taught by Usami.

### ***Response to Arguments***

12. Applicant's arguments filed 2/09/2009 have been fully considered but they are not persuasive:

Applicant's arguments regarding the Usami reference (pp 8-9 of Arguments) are moot in view of the new grounds of rejection necessitated by Applicant's amendments.

Applicant argues that "Chone discusses a single layer film of metal oxide semiconductor particles, wherein various types of particles are mixed...a two-layer system is described by the particles size in both layers are similar..."(pp 9-10 of Arguments).

The Examiner notes that Chone is now utilized as an anticipatory reference for instant claims 1, 7-9, 20-21, and 24. Chone teaches a two-layer system having a first kind and a second kind of particles, the second kind of particles having a larger average diameter than the first kind of particles (paragraph [0029]-[0031]).

### ***Contact/Correspondence Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shannon Gardner whose telephone number is (571)270-5270. The examiner can normally be reached on Monday to Thursday, 8am-5pm EST.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on 571.272.1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/S. G./  
Examiner, Art Unit 1795

/Alexa D. Neckel/  
Supervisory Patent Examiner, Art Unit 1795